Etornam Atsu Avuglah
Booker T. Washington High School
Tuskegee, AL USA
Jordan, Water Scarcity
August 30, 2026

Jordan's Water Crisis: Challenges and Strategies for Sustainable Water Security

Jordan is among the most water-scarce countries in the world, and rapid population growth has intensified pressure on its limited water resources. Jordan's population grew from approximately 853,000 in 1960 to more than 11.5 million in 2024, an increase of about 1,250 percent (World Bank, 2024). Population growth, urbanization, and the arrival of refugees have increased demand for drinking water, agricultural water, sanitation, and other infrastructure. Jordan therefore needs a long-term national water strategy that expands reliable water supplies while improving the efficiency of existing systems. The government should continue investing in water infrastructure, desalination, wastewater reuse, water conservation, and demand-management programs to ensure that the country's limited resources can support its growing population (Ministry of Water and Irrigation [MWI], 2023; World Bank, 2023a).

These national statistics become more tangible when viewed through the daily life of an ordinary Jordanian. Ahmad, a 25-year-old administrator in Amman earning about $690 per month, lives with his family of five and experiences the country's water crisis firsthand. Each morning, he shares a simple breakfast of flatbread and olive oil before commuting to work, passing aging infrastructure that causes significant water losses before treated water reaches households. With only 61–84 cubic meters of renewable freshwater available per person annually, far below the United Nations' absolute water-scarcity threshold of 500 cubic meters, water rationing is a regular part of his life. His neighborhood receives a reliable supply only on Tuesdays, while intermittent pressure can further strain deteriorating pipes and cause water to be lost before it reaches homes. At lunch, the crisis remains evident: agriculture consumes roughly half of Jordan's water resources while contributing only 6.9% of GDP, despite its importance to food security. Later, conversations with friends turn to possible solutions, including stronger pricing for excessive water use and investment in solar-powered desalination along the Red Sea. When Ahmad returns home to find no water from the bathroom faucet, the reality is clear: Jordan's water crisis is not simply a national statistic but a daily challenge shaped by extreme scarcity, aging infrastructure, agricultural demand, and population growth. (MWI, 2023; U.S. Department of Agriculture, 2025; United Nations Jordan, 2020; World Bank, 2024.)

Jordan faces severe water scarcity, with only about 61 cubic meters of renewable freshwater available per person annually, far below the United Nations' threshold of 500 cubic meters for absolute water scarcity (MWI, 2023). Because natural supplies cannot meet demand, the country increasingly relies on groundwater, treated wastewater, and costly water-transfer infrastructure. To strengthen long-term water security, Jordan must diversify its water sources through wastewater reuse, rainwater harvesting, conservation, and improved water efficiency (MWI, 2023; World Bank, 2023a). Desalination is also an important part of this strategy. Jordan plans to desalinate Red Sea water in Aqaba and transport it to major population centers such as Amman. While desalination provides a reliable supply less dependent on rainfall and groundwater, its high energy and infrastructure costs remain challenges. Integrating desalination with renewable energy, particularly solar power, could help lower both environmental and economic costs. A solar-powered desalination system could therefore provide Jordan with a more sustainable water source while reducing fossil-fuel dependence and supporting the country's growing population.

Jordan's dependence on groundwater is also creating a serious long-term problem because groundwater is being withdrawn faster than many aquifers can naturally recover. Brückner et al. (2021) found substantial groundwater-level declines throughout Jordan, with declines exceeding 100 meters in some areas and some wells decreasing by up to 10 meters per year. The researchers also identified major groundwater deficits in important aquifer systems. The findings demonstrate that continued dependence on groundwater at current levels is unsustainable. Jordan should therefore reduce pressure on aquifers by expanding desalination, increasing wastewater reuse, improving irrigation efficiency, and strengthening controls on groundwater abstraction. Reducing withdrawals would give aquifers a greater opportunity to recover and would help preserve groundwater for future generations.

Agriculture places significant pressure on Jordan's limited water supply. The agricultural sector consumes approximately half of the country's water resources while contributing about 6.9 percent of its gross domestic product (U.S. Department of Agriculture, 2025). This does not mean that agriculture is unimportant; rather, it demonstrates why agricultural water efficiency is especially important in a country with extremely limited freshwater resources. Jordan should continue replacing inefficient irrigation practices with high-efficiency systems such as drip irrigation and precision irrigation. The government should also encourage farmers to grow crops that generate greater economic value relative to the amount of water they require. Agricultural policies and subsidies should encourage efficient water use rather than unintentionally promoting the cultivation of particularly water-intensive crops (World Bank, 2023a).

Wastewater reuse provides another opportunity to reduce the amount of freshwater used for agriculture. Jordan already makes substantial use of treated wastewater, and approximately 47 percent of the water allocated to irrigation is derived from treated wastewater (World Bank, 2023a). Expanding this practice could reserve higher-quality freshwater for drinking and household uses while using treated wastewater for appropriate agricultural and industrial applications. Research has also demonstrated the potential for treated wastewater to be used with drip-irrigation systems in Jordan (Al-Mefleh et al., 2021). Jordan should therefore continue expanding wastewater-treatment capacity and modern irrigation systems so that more agricultural production can be supported with nontraditional water resources.

Jordan also loses a substantial amount of water through non-revenue water (NRW). Approximately half of the water supplied by some municipal systems is classified as NRW due to physical leakage, illegal connections, theft, inaccurate meters, and other commercial losses (MWI, 2023; World Bank, 2023a). NRW is therefore a major opportunity to improve water security because reducing losses can effectively increase the amount of water available to consumers without requiring an equivalent increase in water production. Instead of relying exclusively on expensive new water supplies, Jordan should invest heavily in repairing deteriorating distribution networks, improving pressure management, replacing inaccurate meters, and identifying illegal connections. The World Bank's Jordan Water Sector Efficiency Project exemplifies this approach by supporting investments in distribution-system rehabilitation, NRW reduction, and energy efficiency (World Bank, 2023a).

Jordan’s intermittent water-supply system creates significant challenges for managing its aging distribution networks. Because many households receive water only periodically, residents must store water for later use. Research in Zarqa highlights the importance of leak detection, pressure management, and rapid responses in reducing losses in intermittent systems (Aboelnga et al., 2019). Jordan should therefore modernize its distribution infrastructure, replace deteriorated pipes, and strengthen pressure management and network monitoring to improve reliability and reduce water loss. Modern leak-detection technologies could further improve efficiency. Underground leaks can remain unnoticed for long periods,

especially in aging networks. Acoustic sensors, digital monitoring, and machine-learning systems can help utilities detect and locate leaks earlier (Mousavi et al., 2021). Expanding these technologies could reduce water losses and repair costs while improving the overall efficiency and reliability of Jordan's water-distribution system.

Illegal water abstraction and theft create another serious challenge. Illegal wells, unauthorized connections, and unregulated water markets reduce the amount of water available through the formal system and can increase groundwater depletion. Klassert et al. (2023) found that Jordan has developed a significant illegal water market and that unregulated water sales contribute substantially to groundwater abstraction above sustainable levels. The Jordanian government should strengthen enforcement against illegal wells, unauthorized connections, and theft from public water infrastructure. However, enforcement should be paired with improved legal access to water and transparent regulation so communities are not forced into informal markets because of inadequate legitimate supplies. Modern monitoring technologies could also help authorities identify unauthorized wells and connections more efficiently.

Water meters are another important component of Jordan's water-management system. Inaccurate, damaged, outdated, or tampered meters can cause water consumption to be under-recorded, reducing utility revenue and making it difficult to determine how much water consumers are actually using. Jordan's National Water Strategy identifies modern smart meters as an important component of reducing NRW and improving water-management efficiency (MWI, 2023). The government should therefore accelerate replacing obsolete meters with accurate, tamper-resistant smart meters. Digital monitoring could also help utilities identify unusual consumption patterns that may indicate leaks, meter problems, or unauthorized connections. Improving metering would make the water system more financially sustainable while providing better information for managing demand.

Water pricing can also influence consumption. Jordan already uses an increasing-block tariff structure in which higher levels of consumption are subject to higher rates. Rather than introducing a completely new progressive tariff system, the government should continue refining the existing structure so that essential household water remains affordable while excessive consumption faces stronger economic incentives for conservation (MWI, 2023). This approach could be particularly important for high-income households and properties that use large quantities of water for landscaping, swimming pools, and other nonessential purposes. Additional revenue generated from higher consumption levels could be reinvested in infrastructure rehabilitation, leak reduction, and water-efficiency programs. At the same time, the government should protect low-income households from excessive financial burdens through targeted subsidies or other affordability measures.

Jordan's limited and uneven rainfall further complicates water security. Because much of the country is arid or semi-arid, rainwater harvesting can provide a useful supplementary source, particularly for non-potable uses. Studies suggest that well-designed rooftop systems can reduce demand for conventional water supplies (Abdulla, 2020; Abu-Zreig et al., 2019). Jordan could expand rainwater harvesting in new homes, commercial buildings, schools, and government facilities, using collection systems and storage tanks to reduce pressure on municipal networks during periods of adequate rainfall.

Water scarcity also directly affects food security. Limited freshwater and arable land restrict domestic food production, while reliance on imports leaves Jordan vulnerable to international price and supply disruptions. A 2020 assessment found that 53% of Jordanians were vulnerable to food insecurity, with about 3% experiencing food insecurity (United Nations Jordan, 2020). To improve food security without

increasing freshwater demand, Jordan should expand precision irrigation, treated wastewater use, greenhouse agriculture, efficient farming methods, and water-efficient crop selection.

These challenges demonstrate that Jordan's water crisis requires an integrated approach rather than a single solution. Agricultural efficiency alone cannot solve the problem if groundwater is over-pumped or distribution networks continue to leak, just as desalination cannot fully address the crisis if water is lost through leakage, illegal abstraction, and inefficient consumption. Jordan must therefore balance increasing water supplies with reducing demand and losses across the agricultural, municipal, and industrial sectors.

Jordan's National Water Strategy 2023–2040 provides a framework for addressing the country's water challenges by improving supply reliability, reducing non-revenue water, increasing efficiency, strengthening governance, expanding alternative water sources, and addressing climate change (MWI, 2023). Building on this framework will require a combination of infrastructure modernization, desalination powered by renewable energy, wastewater reuse, agricultural efficiency, rainwater harvesting, smart metering, leak detection, appropriate water pricing, and stronger enforcement against illegal water use.

Ultimately, Jordan's water crisis is driven by interconnected pressures, including population growth, extreme water scarcity, groundwater depletion, agricultural demand, climate variability, aging infrastructure, water losses, illegal abstraction, and inefficient consumption. These challenges extend beyond water security to food security, as unreliable water supplies can reduce crop yields, limit livestock production, increase agricultural costs, and threaten the availability and affordability of food. Strengthening water management is therefore essential not only to securing Jordan's water supply but also to improving domestic food production and reducing vulnerability to food insecurity.

No single solution can address all of these challenges. Jordan should instead pursue a comprehensive strategy that increases the country's reliable water supply while reducing losses and improving the productivity of every cubic meter of water already available. Desalination can provide additional water resources; wastewater recycling can reduce pressure on freshwater supplies and support agricultural production; precision irrigation can improve water-use efficiency and increase agricultural productivity; modern infrastructure can reduce non-revenue water losses; smart meters can improve accountability; and stronger enforcement can protect limited public water resources. Together, these measures can help ensure that scarce water is used more efficiently to support both household needs and food production.

The Jordanian water crisis is therefore not simply a problem of insufficient water; it is also a problem of how existing water resources are managed. Because agriculture depends heavily on reliable access to water, ineffective water management can directly contribute to food insecurity by limiting production and increasing dependence on imported food. Jordan has already developed important policies and technologies for addressing these challenges, but implementation, investment, enforcement, and long-term planning will determine their success. By combining supply diversification with aggressive water conservation, infrastructure modernization, agricultural reform, groundwater protection, and improved governance, Jordan can strengthen both its water security and its food security. A comprehensive approach will be essential if Jordan is to provide reliable water for its growing population while also sustaining agricultural production and protecting its limited natural resources for future generations**.** In this context, solving Jordan's water crisis is not only an environmental or infrastructure priority; it is also critical to addressing food insecurity, because sustainable and reliable access to water is necessary to produce, process, and maintain an adequate food supply.

References

Aboelnga, H. T., Ribbe, J., Frechen, F.-B., & Sogancioglu, M. (2019). Modelling the leakage rate and reduction using minimum night flow analysis in an intermittent supply system. *Water, 11*(1), 48. https://doi.org/10.3390/w11010048

Abdulla, F. (2020). Rainwater harvesting in Jordan: Potential water saving, optimal tank sizing and economic analysis. *Urban Water Journal, 17*(5), 446–456. https://doi.org/10.1080/1573062X.2019.1648530

Abu-Zreig, M., Ababneh, F., & Abdullah, F. (2019). Assessment of rooftop rainwater harvesting in northern Jordan. *Physics and Chemistry of the Earth, Parts A/B/C, 114*, 102794. https://doi.org/10.1016/j.pce.2019.08.002

Al-Mefleh, N. K., Talozi, S., & Abu Naser, K. (2021). Assessment of treated wastewater reuse in drip irrigation under different pressure conditions. *Water, 13*(8), 1033. https://doi.org/10.3390/w13081033

Brückner, F., Bahls, R., Alqadi, M., Lindenmaier, F., Hamdan, I., Alhiyari, M., & Atieh, A. (2021). Causes and consequences of long-term groundwater overabstraction in Jordan. *Hydrogeology Journal, 29*, 2789–2802. https://doi.org/10.1007/s10040-021-02404-1

Klassert, C., Yoon, J., Sigel, K., Klauer, B., Talozi, S., Lachaut, T., Selby, P., Knox, S., Avisse, N., Tilmant, A., Harou, J. J., Mustafa, D., Medellín-Azuara, J., Bataineh, B., Zhang, H., Gawel, E., & Gorelick, S. M. (2023). Unexpected growth of an illegal water market. *Nature Sustainability, 6*, 1406–1417. https://doi.org/10.1038/s41893-023-01177-7

Ministry of Water and Irrigation. (2023). *National water strategy 2023–2040*. Hashemite Kingdom of Jordan. National Water Strategy 2023–2040

Mousavi, S. J., Burtea, V., & others. (2021). Ensemble-based machine learning approach for improved leak detection in water mains. *Journal of Hydroinformatics, 23*(2), 307–323. https://doi.org/10.2166/hydro.2021.093

United Nations Jordan. (2020). *Jordan food security update: June–August 2020*. Jordan Food Security Update

U.S. Department of Agriculture, Foreign Agricultural Service. (2025). *Jordan: Agricultural sectors*. Jordan Agricultural Sectors

World Bank. (2023a). *Jordan water sector efficiency project*. Jordan Water Sector Efficiency Project

World Bank. (2023b, June 18). *Estimated 1.6 million people in Jordan to benefit from new project to tackle Jordan's water crisis and build climate resilience*. World Bank: Jordan Water Crisis and Climate Resilience

World Bank. (2024). *Population, total—Jordan*. World Development Indicators. World Bank: Jordan Population Data